News Article for RISUD Strategic Focus Area (SFA) Scheme

		Name	**Department**
1.	**Principal Investigator**:	Prof. Hai GUO	CEE
2.	**Name of SFA:**	Urban Air Pollution and Health	
3.	**Project Title:**	Urbanization and Atmospheric Air Pollution: Anthropogenic Processes and Human Exposure/Health	

4. **First Year Progress/Achievement**

Hong Kong is one of the largest megacities in Asia, with dense population and motor vehicles. Air pollution has been concerned as an increasing risk of human health in Hong Kong. Under the support of RISUD, this project aimed to enhance our knowledge on the primary and secondary air pollutants and their health effects in Hong Kong. During this reporting period, we carried out three sampling campaigns in different places of Hong Kong, with a set of state-of-the-art instruments, to clearly characterize the air pollutants compositions in roadside, urban and background atmospheres. The sources of the identified air pollutants, particularly the organic aerosols in airborne particulate matters (PMs) were resolved. The airborne PMs collected at the roadside site were also examined for its toxicities. Briefly, the specific mice models were exposed to PMs at a low dose level for a long period, the inflammatory response in the lung of the mice were assessed through monitoring of a series of biological indexes. In addition to examining the impairment of airborne PMs to lung function, we also tested its impacts on the neurocognitive health. The mice under the exposure of PMs accepted the tests of their cognitive ability to novel objects. It should be noted that both the maternal mice and offspring were studied in these exposure experiments. To establish the relationships between air pollution and human health, the epidemiological studies were also carried out. We investigated the possible cause – effect relationships between the diverse air pollutants and some of the commonly known diseases, such as asthma and the other cardiorespiratory diseases, type 2 diabetes, peptic ulcer bleeding and stoke.

With these progresses, the objectives of this project have been partially achieved during this reporting period. First, both the primary and secondary air pollutants are better understood, with the aid of the high resolution measurement techniques. For example, we found that the secondary organic aerosols (SOAs) overrode the primary organic aerosols (POAs) in the airborne PMs of Hong Kong, even at the roadside site. The cooking emissions constituted a considerable fraction of OAs, which even played a more important role than vehicle emissions at both the roadside site and urban site. The regional transport of OAs to Hong Kong was also confirmed by the high levels of biomass burning tracers observed at all the sites. Second, our understandings on the toxicities of air pollution in Hong Kong were also advanced. Significant inflammatory response was observed in the lung of mice, after 3 weeks' exposure to PMs though the dose was low. We found that ambient volatile organic compounds (VOCs) were associated with the increased risks of heart failure in the Hong Kong population, while the long term exposure to PMs might induce the prevalence and incidence of type 2 diabetes, especially in women. Third, the long term trends of human exposure to air pollutants in Hong Kong have been figured out. The exposures to most air pollutants decreased significantly in Hong Kong in the past decade. An overall increasing trend was identified for the exposure to ozone (O_3).

The good news is that O_3 in the rural atmosphere began to decrease in these years. However, a significant increase was observed for O_3 in the roadside atmosphere, which indicated the elevated human exposure to O_3 in this microenvironment.

In addition, a lot of other activities were conducted in this reporting period. Two workshops with the health scientists from Germany were held in March 2018. We also hosted a workshop on "Urban air pollution and Health" in PolyU in June 2018. More than 20 top scientists from China and overseas attended this workshop, presented their work and discussed the future collaboration. To pursue better progress, we recruited a Research Assistant specific for the mice exposure experiment. One of our collaborators – Prof. Allen Goldstein from UC Berkeley, is visiting us for the collaboration on this project. Inspired by this project, we also submitted three proposals for consideration of funding under different schemes. Five papers generated from this project were submitted, with three published, one under minor revision and one under review. All of them acknowledged the financial support of RISUD.
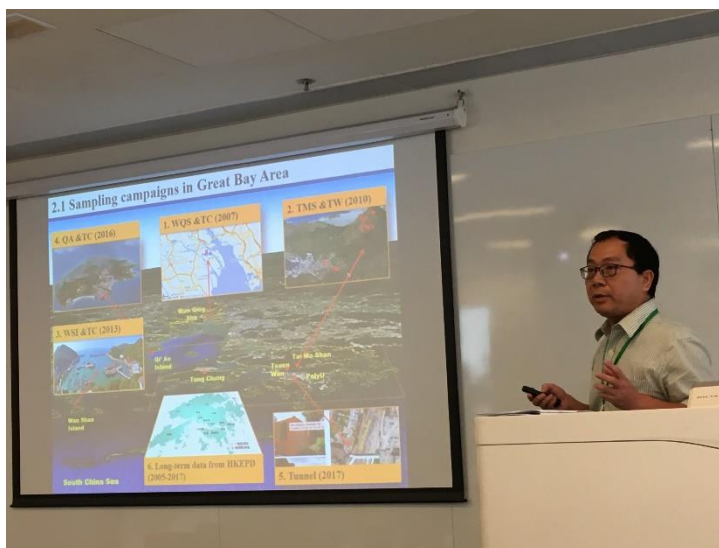

Figure 1. Prof. Guo talk at RAIS workshop in June 2018

Overall, this project enhanced our knowledge on air pollution and health in Hong Kong. Furthermore, the accumulated knowledge and the well-cooperated research team arisen from this project contributed to the development of RISUD, and the other activities (such as workshops and publications) promoted the vision and mission of RISUD to the communities, which helped to increase the impact of RISUD.
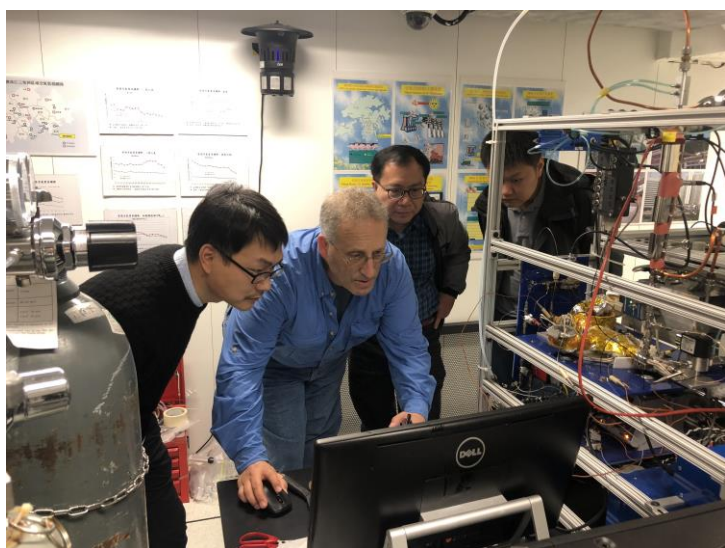

Figure 2. Prof. Goldstein, Guo, Dr. Lyu and Mr Yao at Hok Tsui site

Figure 3. Prof. Morawska (QUT, Australia), Prof. Guo, Drs. Lyu and Liu, Mr. Yao and Lu at Cross-Harbor Tunnel